# The Caltrans Stormwater Monitoring Protocols Guidance Manual

*Presented by:*
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# Chronology:

Caltrans Statewide Monitoring Program: initiated 1995-96

- First efforts to standardize, coordinate District activities

Caltrans Stormwater Monitoring Protocols

- First Edition: August, 1997
- Second Edition: July, 2000

Caltrans Data Reporting Protocols

- First version: July, 2000

*(updated annually; components added as protocols developed)*

Caltrans Litter Monitoring Protocols

- First Edition: October, 2000

Caltrans Toxicity Study Protocols

- First Edition: October, 2001

Caltrans Particle/Sediment Monitoring Protocols

- First Edition: due 2002 (in prep.)

# Caltrans Stormwater Monitoring Protocols Guidance Manual

## Contributors:

*First Edition (August 1997):*

Caltrans
Larry Walker Associates
Woodward-Clyde Consultants
CSU, Sacramento
Camp Dresser & McKee

*Second Edition (July, 2000):*

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# Caltrans Stormwater Monitoring Protocols Guidance Manual
# Purpose, Goals, Benefits

*Purpose:*

Establishes uniform policies and procedures
- for runoff water quality monitoring
- specific to transportation-related facilities

*Primary Goals:*

Provide consistency in monitoring methods
- among Caltrans various programs, projects, locations
- over time

Ensure production of high quality (accurate, precise) data

*Benefits:*

Provides for data comparability
Enhances data management (storage, retrieval, analysis)
Ensures data reliability

# Caltrans Stormwater Monitoring Protocols Guidance Manual

## Organization

## Part I: Preparing the Monitoring Plan

## Part II: Implementing the Monitoring Plan

*Inherent concept:*

*All monitoring projects will have written methods/procedures*

# Caltrans Stormwater Monitoring Protocols Guidance Manual

## Part I: Preparing the Monitoring Plan

- *Develop Purpose and Objectives*
- *Site Selection*
- *Constituent Selection*
- *Selection of Monitoring Methods and Equipment*
- *Sampling and Analysis Plan*

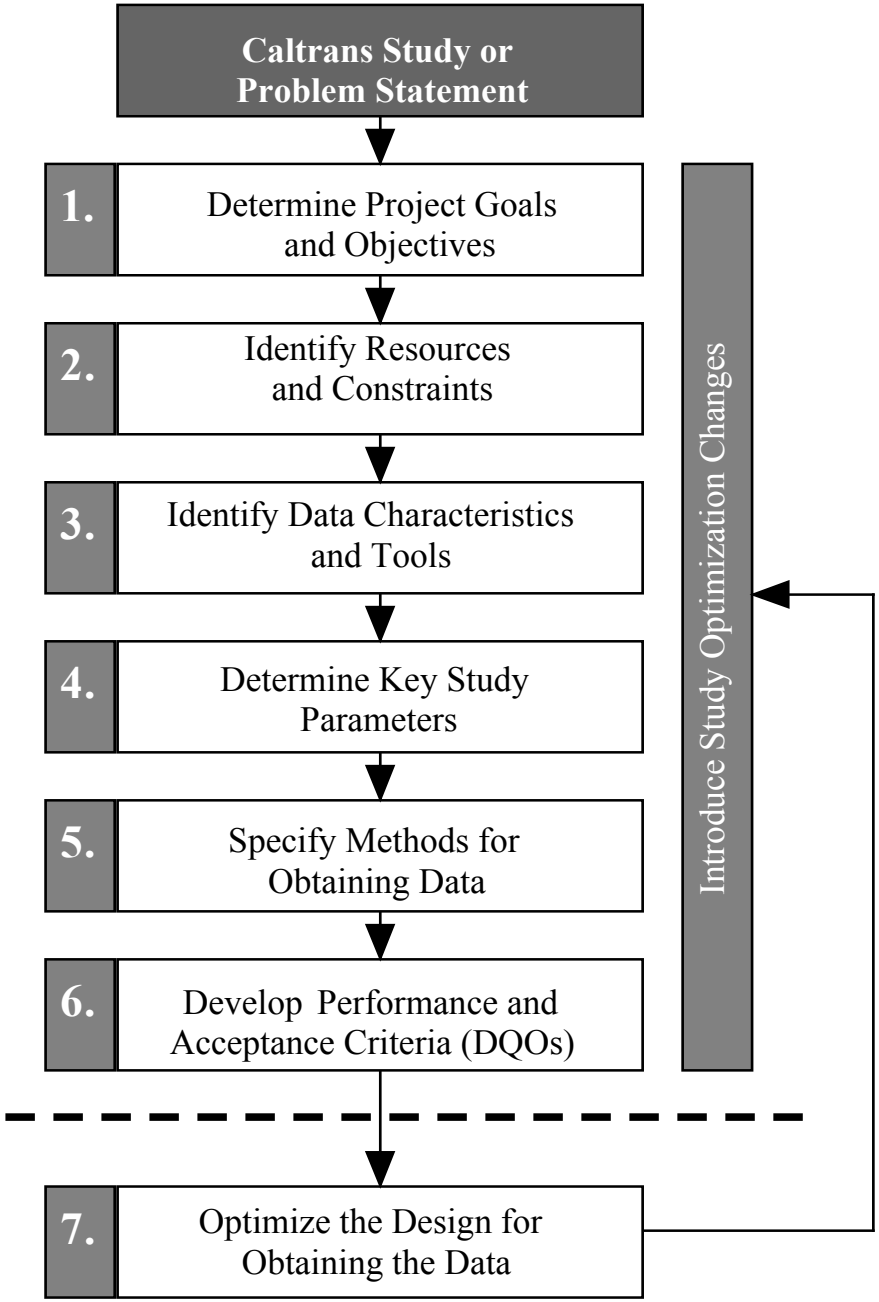


**Figure 2-1. Systematic Planning Process Flow Chart**

# Caltrans Stormwater Monitoring Protocols Guidance Manual

## Part I: Preparing the Monitoring Plan

### *Site Selection*

- Representativeness
- Personnel Safety
- Site Access
- Equipment Safety
- Flow Measurement Capability
- Electrical Power and Telephone
- Non-Caltrans Sources
- BMP Effectiveness
- Site Visit

# Figure 4-1. Flow chart of constituent selection process

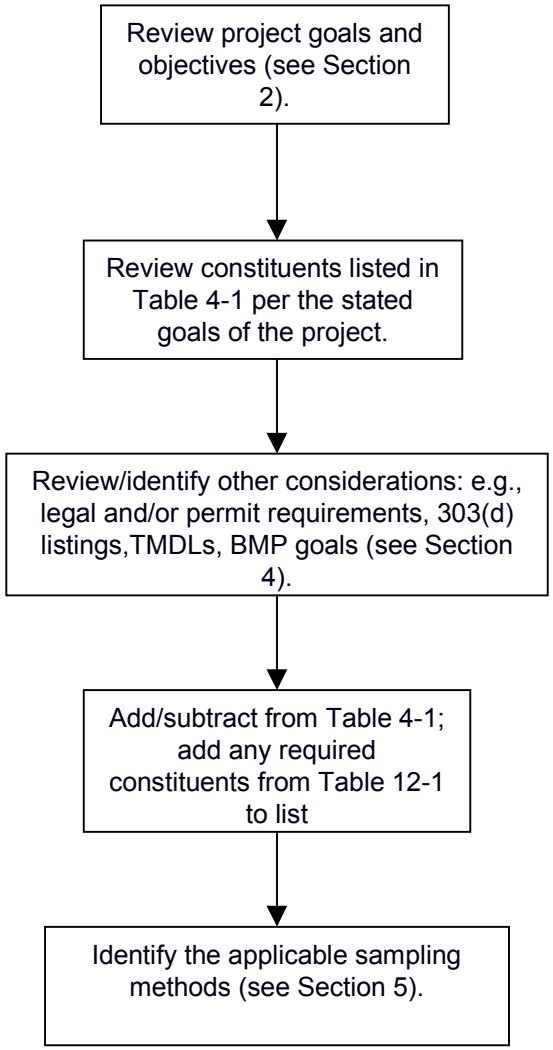

Table 4-1. Minimum Constituent List for Characterization (1)

| | ***Units*** | ***RL*** |
|---|---|---|
| ***Constituent/Parameter name*** | | |
| ***Conventional*** | | |
| Conductivity | µmhos/cm | ±1(2) |
| Hardness as $CaCO_3$ | mg/L | 2 |
| pH | pH Units | ±0.1(2) |
| Temperature | °C | ±0.1(2) |
| Total Dissolved Solids (TDS) | mg/L | 1 |
| Total Suspended Solids (TSS) | mg/L | 1 |
| Dissolved Organic Carbon (DOC) | mg/L | 1 |
| Total Organic Carbon (TOC) | mg/L | 1 |
| ***Nutrients*** | | |
| Nitrate as Nitrogen ($NO_3$-N) | mg/L | 0.1 |
| Total Kjeldahl Nitrogen (TKN) | mg/L | 0.1 |
| Total Phosphorous | mg/L | 0.03 |
| Dissolved Ortho-Phosphate | mg/L | 0.03 |
| ***Metals (total recoverable and dissolved)*** | | |
| Arsenic (As) | µg/L | 1 |
| Cadmium (Cd) | µg/L | 0.2 |
| Chromium (Cr) | µg/L | 1 |
| Copper (Cu) | µg/L | 1 |
| Lead (Pb) | µg/L | 1 |
| Nickel (Ni) | µg/L | 2 |
| Zinc (Zn) | µg/L | 5 |
| ***Organic Compounds***(3) | | |
| Diuron | µg/L | 1 |
| Glyphosate | µg/L | 5 |
| Oryzalin | µg/L | 1 |
| Oxadiazon | µg/L | 0.05 |
| Triclopyr | µg/L | 0.1 |

(1) For analytical methods and other specifications, see ***Table 12-1*** in ***Section 12***.

(2) Refers to instrument resolution.

(3) Analysis for the listed herbicides applies to Caltrans statewide characterization monitoring only; this analysis may not be appropriate or necessary for other types of projects.

# Caltrans Stormwater Monitoring Protocols Guidance Manual

## Part I: Preparing the Monitoring Plan

## *Selection of Monitoring Methods and Equipment*

- Sample Collection Methods
- Sample Collection Equipment
- Flow Measurement Methods and Equipment
- Precipitation Measurement
- System Integration
- System Command/Control
- Remote Communication
- Data Management

# Caltrans Stormwater Monitoring Protocols Guidance Manual

## Part I: Preparing the Monitoring Plan

### *Selection of Monitoring Methods and Equipment*

- Flow-proportioned composites preferred
  - Best representation of quality throughout event
  - Analytical results represent “EMC”
- Use automated equipment when feasible
  - Typical set-up: Autosampler, flow meter, rain gauge, datalogger, modem

# Caltrans Stormwater Monitoring Protocols Guidance Manual

## Part II: Implementing the Monitoring Plan

- *Equipment Installation and Maintenance*
- *Training*
- *Preparation and Logistics*
- *Sample Collection*
- *Quality Assurance/Quality Control*
- *Laboratory Sample Preparation and Analytical Methods*
- *QA/QC Data Evaluation*
- *Data Reporting Protocols*

# Caltrans Stormwater Monitoring Protocols Guidance Manual

## Part II: Implementing the Monitoring Plan

## *Sample Collection*

### ***Clean Sampling Techniques***

Reduce potential sample contamination:

- At least two persons, wearing clean, powder-free nitrile gloves at all times, are required on a sampling crew.
- Clean techniques must be employed whenever handling containers or equipment used for collection of samples for trace metals or organics analysis.

# Caltrans Stormwater Monitoring Protocols Guidance Manual

## Part II: Implementing the Monitoring Plan

### *Sample Collection*

#### ***Sampling Event Representativeness Criteria***

**Table 10-1. Monitoring Event Representativeness Requirements**

| *Total Event Precipitation* | *Minimum Acceptable Number of Aliquots* | *Percent Capture Requirement* |
|---|---|---|
| 0-0.25” | 6 | 85 |
| 0.25-0.5” | 8 | 80 |
| 0.5-1” | 10 | 80 |
| >1” | 12 | 75 |

# Example QC Sample Schedule

| *Site* | *Pre-Season* | *Event #1* | *Event #2* | *Event #3* | *Event #4* |
|---|---|---|---|---|---|
| Site 1 | | MS/MSD | | Field Duplicate (Site C) | Field Blank (Site B) |
| Site 2 | Equipment Blank (Site A1) | Field Blank (Site B) | MS/MSD | | Lab Duplicate |
| Site 3 | | Field Duplicate (Site C) | Field Blank (Site B) | MS/MSD | |
| Site 4 | Equipment Blank (Site A2) | | Lab Duplicate | Field Blank (Site B) | MS/MSD |
| Laboratory | Composite bottle blank; sample bottle blanks | | | | |

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## Part II: Implementing the Monitoring Plan

## *QA/QC Data Evaluation*

- Initial Data Quality Screening
  - Verify consistency: SAP/COC/Lab Reports
  - Check lab report completeness
  - Check for obvious errors: typos/incongruities
- Data Quality Evaluation
  - Reporting Limits
  - Holding Times
  - Contamination (blanks)
  - Accuracy (spikes)
  - Precision (duplicates)

# Other Caltrans Data Management Tools (available on CD)

*Hydrologic Utility*

- Produce event hydrograph and
- evaluate compliance with representativeness criteria

*Lab EDD Error Checker and*
*Automated Data Validation Software*

- Checks electronic lab reports for errors and
- Compares results to DQOs

*Data Analysis Tool*

- Produces descriptive statistics
- Handles non-detect values

# Caltrans Monitoring Protocols – Master Guidance Manual *(DRAFT)*

*Contains:*

- Stormwater Quality Monitoring Protocols
- Particle/Sediment Monitoring Protocols
- Litter Monitoring Protocols
- Toxicity Study Protocols

- Caltrans Data Reporting Protocols

(2 copies available for viewing)

Caltrans Stormwater Program web site:

http://www.dot.ca.gov/hq/env/stormwater/index.htm

Special Documents web site:

http://www.dot.ca.gov/hq/env/stormwater/special/index.htm

Select: *Caltrans Guidance Manual: Storm Water Monitoring Protocols*